

ARIZONA HIGHWAY SAFETY IMPROVEMENT PROGRAM MANUAL

Arizona Department of Transportation

Traffic Engineering Group

Traffic Safety Section

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1. INTRODUCTION

This manual documents the Arizona Highway Safety Improvement Program (HSIP) and defines Arizona Department of Transportation's (ADOT's) program for project evaluation, statewide prioritization, and development of HSIP projects based on uniform and objective criteria. The purpose of the Arizona HSIP is to achieve a significant reduction in traffic fatalities and serious injuries on all public roads in Arizona. This manual provides guidance for planning, implementation, and evaluation of HSIP projects in Arizona to achieve this stated purpose of reducing fatalities and serious injuries. This manual supersedes previous versions of the Arizona HSIP manual and will continue to be updated as federal requirements or state procedures change.

This manual is organized in two sections, with some supporting appendices. The remainder of this first introductory section of the manual outlines legislative direction related to the Arizona HSIP, including annual reporting requirements. The second section describes components and programs relating to the Arizona HSIP and provides details on the planning, implementation, and evaluation of HSIP projects. The appendices contain detailed direction regarding the HSIP application the process including specific criteria for project eligibility and provides reference countermeasures to support the planning process. Appendix information may be updated periodically.

1.1 HSIP Legislation

The Highway Safety Improvement Program (HSIP), Codified as Section 148 of Title 23, United States Code ([23 U.S.C. 148](#)) remains as one of the core federal-aid programs in the new federal surface transportation act, "Moving Ahead for Progress in the 21st Century" (MAP-21), which was signed into law on July 6, 2012. The specific provisions of the HSIP are defined in Section 1112 of MAP-21 with implementing regulations [23 CFR Part 924](#).

Web-link –
[Moving Ahead for Progress in the 21st Century \(MAP-21\)](#)

Web-link –
[History of Federal HSIP](#)

Web-link –
[Federal HSIP
Policy/Guidance](#)

*State HSIP includes:
Planning,
Implementation,
and Evaluation*

Legislation requires that each state develop and implement a Strategic Highway Safety Plan (SHSP) and administer the Railway-Highway Grade Crossing Program ([23 U.S.C. 130](#)). The State HSIP should be consistent with the SHSP emphasis areas and strategies. The State HSIP may be flexible to meet the needs of the State, but must include the following components:

- Planning – Collect and maintain data, identify highway safety issues, conduct engineering studies, and establish priorities.
- Implementation – Schedule and implement projects.
- Evaluation – Determine the effectiveness of safety improvements.

Findings resulting from the Evaluation process shall be incorporated as basic source data in the Planning process.

1.1.1 Strategic Highway Safety Plan

The SHSP is a multi-year statewide-coordinated safety plan that provides a comprehensive framework for reducing fatalities and serious injuries on all public roads. It is data-driven and establishes statewide safety goals, objectives, and key emphasis areas. This plan must be developed through a multi-disciplinary approach that considers transportation safety countermeasures and strategies in all “4 E’s” of safety: engineering, enforcement, education, and emergency services. The SHSP allows highway safety programs and partners in each state to work together to align goals, leverage resources and collectively address safety challenges.

Arizona developed the most recent update to their SHSP in 2014. The Arizona 2014 SHSP is data-driven and was developed in collaboration with safety stakeholders throughout the state. The plan defines emphasis areas and strategies to achieve a goal to reduce fatalities and the occurrence and severity of serious injuries on all public roadways in Arizona. The multi-year statewide safety objective is to reduce the total number of fatalities and serious injuries in Arizona by three to seven percent during the next five years from the 2013 base year.

Web-link –
[FHWA SHSP
Guidance](#)

Web-link –
[Arizona SHSP](#)

1.1.2 Railway-Highway Grade Crossing Program

The federal Railway-Highway Grade Crossing Program (RHGCP) reduces the number of fatalities and injuries at public railway-highway grade crossings through the elimination of hazards and/or the installation/upgrade of protective devices at crossings. Each state is required to conduct and systematically maintain a survey of all railway-highway grade crossings to identify crossings which may require separation, relocation, or protective devices, and establish and implement a schedule of projects for this purpose. At a minimum, the crossings identified through the program will have standard signing and striping following guidance from the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

The Arizona RHGCP is funded through a set-aside from the HSIP apportionment. The ADOT Utility and Railroad Section administers and manages this program and maintains an inventory of public railroad crossings, a list of projects, and relevant program guidelines.

1.1.3 Special Rules

MAP-21 established two special rules to address potential safety concerns for High Risk Rural Roads (HRRR) and Older Drivers and Pedestrians. Both involve comparisons of five-year rolling average fatality crash rates to evaluate whether rates are increasing or decreasing. Increasing rates trigger specific actions under the federal HSIP.

High Risk Rural Roads Rule

MAP-21 eliminated previous HRRR annual set-aside funding. However, states are required to obligate a specified amount of HSIP funds in the next fiscal year to HRRRs if the fatality rate on rural roads in that state is increasing over the most recent two-year period. FHWA computes the annual fatality rate as a five-year rolling average for roads functionally classified as Rural Major Collector, Rural Minor Collector, or Rural Local Roads using data from the Fatality Analysis Reporting System (FARS) and Highway Performance Monitoring System (HPMS).

Web-link –
[FHWA
Rail Crossing
Program Guidance](#)

Web-link –
[FHWA
HRRR Guidance](#)

As required by MAP-21, Arizona has defined HRRRs in the updated SHSP. Arizona HRRRs are:

“Roadways that are functionally classified as a Rural Major Collector, Rural Minor Collector or Rural Local Road with a rate for fatalities and/or serious injuries that exceeds the statewide average for those functional classifications of roadways, or are likely to experience an increase in traffic volume that leads to rates for fatalities and/or serious injuries that exceed the statewide average for those functional classifications of roadways.”

Although MAP-21 eliminates the requirement for states to set aside funds for HRRR, Arizona will continue to allocate funds for safety projects on rural roads that meet this definition.

Older Driver and Pedestrians Rule

The Older Driver and Pedestrian Rule states that if traffic fatalities and serious injuries per capita in a state, for drivers and pedestrians over age 65, increases during the most recent two-year period, that state will be required to include strategies to address that increase in the SHSP. Annual fatalities and serious injuries per capita are calculated as a five-year rolling average of older driver and pedestrian fatalities and serious injuries divided by a statewide population rate of all persons 65 and older to the total statewide population.

To assure that the MAP-21 special rule for older drivers and pedestrians requirements are met, the Arizona 2014 SHSP has defined emphasis areas for Age Related safety issues and for Pedestrians. These emphasis areas include several safety strategies intended to improve safety for older drivers and pedestrians.

1.1.4 Funding

Prior to MAP-21, each federally apportioned transportation program had its own formula for distribution, and the total amount of federal assistance a state received was the sum of the amounts it received for each federally funded state

Web-link –
[Guidance on Older
Driver and
Pedestrian Rule](#)

*MAP-21 modifies
funding rules for HSIP
apportionments.*

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transportation program. MAP-21 instead provides a total apportionment for each state and then divides that amount among individual apportioned state transportation programs.

The HSIP federal-aid program receives a percentage of the total apportionment after allocations to CMAQ and Metropolitan Planning. In addition, if the High Risk Rural Roads Special Rule applies, then in the next fiscal year the State is required to obligate for high risk rural roads an amount at least equal to 200% of its FY 2009 HRRR set-aside. The final HSIP apportionment amount represents the funding available to states for the advancement of highway safety improvement projects.

HSIP Funds

A highway safety improvement project means strategies, activities, and infrastructure projects on a public road that are consistent with a state's strategic highway safety plan. As such, traditional infrastructure-related improvements, as well as non-infrastructure projects, are eligible for HSIP funds. Highway safety improvement projects should be identified on the basis of crash experience, crash potential, crash rate, or other safety data-supported means. The data-driven framework for funding projects allows states to administer the HSIP funds to address their specific safety needs. Each state is responsible for developing procedures to administer the HSIP in accordance with the requirements of [23 U.S.C. 148](#) and [23 CFR Part 924](#) and in consultation with the FHWA Division Offices.

This manual outlines the project selection and prioritization process to be used in administering Arizona's HSIP funds. In order to better align the state HSIP with MAP-21 requirements and guidance, changes to HSIP funding allocations are being implemented. Appendix A contains the specific descriptions of eligibility requirements, which may change periodically to align with federal guidance and better achieve Arizona's safety goals.

Infrastructure and non-infrastructure related projects are eligible for HSIP funding.

Federal Share:

The federal share of HSIP projects on interstate highways is determined by a sliding scale rate for Arizona of 94.34 percent of the total project cost, with the remaining 5.66 percent funded by the project sponsor. The federal share on non-Interstate roadways is 94.3 percent, with the remaining 5.7 percent funded by the Sponsor.

The federal share of railway-highway grade crossing projects may amount up to 100 percent for projects for signing, pavement, pavement markings, active warning devices, and crossing closures. In accordance with 23 USC 120(c), some other specific types of projects may also be funded at up to a 100 percent Federal share.

1.1.5 Reporting Requirements

State DOTs are required to submit annually to FHWA a report on HSIP implementation and effectiveness. Reports are submitted as responses to a series of questions covering the below list of information and topics, as well as other specific information:

- Description of the state's HSIP structure, i.e., program administration and program methodology.
- Progress in implementing the HSIP projects, including HSIP funds programmed and the number and general listing of the types of projects initiated.
- Progress in achieving annual safety performance targets, including an overview of general highway safety data trends and the application of special rules for the state.
- HSIP program evaluation describing annual effectiveness of SHSP emphasis areas, groups of similar types of projects, and systemic treatments.

Web-link –
[FHWA HSIP
Reporting Guidance](#)

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The proposed MAP-21 annual safety performance measures, for all public roads, will be reported as a five-year rolling average for the following measures:

- **Fatalities:** The number of persons killed in motor vehicle crashes on all public roads for a calendar year.
- **Serious Injuries:** The number of persons seriously injured in motor vehicle crashes on all public roads for a calendar year.
- **Fatality Rate:** The number of persons killed in motor vehicle crashes per 100 million vehicle miles traveled (HVMVT) for a calendar year.
- **Serious Injury Rate:** The number of persons seriously injured in motor vehicle crashes per HVMVT for a calendar year.

Given the purpose of the HSIP and the new MAP-21 performance management requirements, it is important that states select and implement projects that will contribute to a reduction in fatalities and serious injuries, consistent with their state safety performance targets.

National summary reports, along with each state's most recent approved annual reports, are available through the FHWA.

Web-link –
[Past HSIP Reports](#)

1.1.6 Protection of Data from Discovery & Admission into Evidence

Title 23, Part 409 of the United States Code ([23 USC 409](#)) establishes a policy for the discovery and admission as evidence of certain reports and surveys. This policy protects the information obtained, compiled, and maintained for the use of the HSIP. Protected information includes reports, surveys, schedules, lists, queries, or any data compiled or collected for the purpose of identifying, evaluating, or planning of safety enhancements as outlined in 23 CFR 924. Data used to develop any highway safety improvement project, which may be implemented utilizing federal aid highway funds, shall not be subject to discovery or admitted into evidence in a federal or state court proceeding, or considered for other purposes in any action for damages, arising from an occurrence at a location mentioned or addressed by such data.

2. ARIZONA HSIP PROCESS

ADOT is responsible for administration of the Arizona HSIP.

HSIP projects will support the goal of reducing fatalities and serious injuries.

ADOT is the state agency responsible for the adoption and administration of the HSIP in Arizona. The three components of the Arizona HSIP process are – Planning, Implementation and Evaluation, as shown in Figure 2. Planning, implementation, and evaluation are managed through ADOT’s Traffic Safety Section (TSS). All HSIP programs are in alignment with the MAP-21 compliant Arizona SHSP and will support the goal of reducing fatalities and serious injuries.

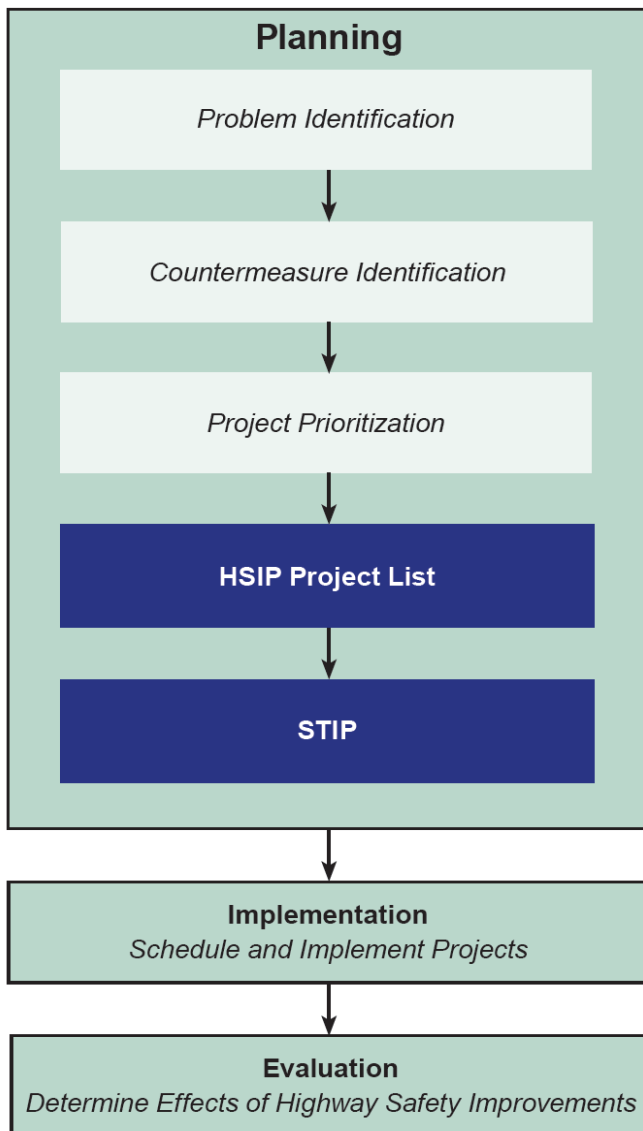


Figure 1. HSIP Components

2.1 Planning

The planning process incorporates the following components: identify locations, identify mitigation measures, prioritization, and HSIP approval.

2.1.1 Location Identification

Location identification involves collecting and maintaining the records of crash, roadway, traffic, and vehicle data on all public roads in order to conduct road safety analyses. The intent of the HSIP is to reduce the frequency and overall severity of motor vehicle crashes occurring within Arizona. Remediation efforts will focus on crashes resulting in serious injury or death and their attendant circumstances and causes.

Candidate locations, either segments or intersections, are identified for spot improvements, as well as systemic improvements, using network screening methods and available crash and exposure data. This allows the analyst to identify trends, establish expected averages, find statistically significant anomalies, and anticipate areas of interest. This data-driven process allows for rational, unbiased prioritization of projects. Specific eligibility criteria for developing projects are defined in Appendix A.

The Arizona SHSP contains 12 safety emphasis areas, and two additional emphasis area support areas where strategies are focused on the most important safety challenges throughout the state. The HSIP is used to directly address the goal of the SHSP, and all HSIP projects must align with one or more safety strategies in the SHSP. ADOT addresses applicable strategies in the SHSP predominately as infrastructure projects.

Each year, the ADOT TSS will identify fatal and serious injury crash locations on all public roads related to the SHSP emphasis areas. Based on this crash data, the ADOT TTS will identify candidate locations for safety improvement projects on the State Highway System, and MPOs, COGs, and other public road owners will identify candidate locations for safety improvement projects on non-State Highway System

*The HSIP Project
Application
Process is detailed
in Appendix A*

roadways. Individual crashes usually fall under multiple emphasis area categories and some emphasis areas are not necessarily associated with a number of severe crash events. Emphasis area categories, defined in the Arizona SHSP, are as follows:

SHSP Emphasis Areas

- Speeding and Aggressive Driving
- Impaired Driving
- Occupant Protection
- Motorcycles
- Distracted Driving
- Roadway Infrastructure and Operations
 - Lane departure
 - Intersection
- Age Related
 - Young Drivers
 - Older Drivers
- Heavy Vehicles / Buses / Transit
- Nonmotorized Users
 - Bicyclists
 - Pedestrians
- Natural Risks
 - Weather
 - Animal
- Traffic Incident Management
- Interjurisdictional

*Emphasis Areas
focus on Arizona's
most important
transportation
safety challenges.*

SHSP Emphasis Areas Support

- Data Improvements
- Policy Initiatives

State and local candidate locations will be considered and evaluated in a performance based manner. Funding will be allocated to projects addressing SHSP Emphasis Areas and supporting the goal of reducing fatalities and serious injuries. The ADOT Local Public Agency (LPA) section will provide assistance to local agencies throughout the process of identifying and developing projects.

2.1.2 Countermeasure Identification

The process to identify effective mitigation measures for HSIP projects should consider the expected reduction in the number of fatalities and serious injuries, cost effectiveness of the projects, related emphasis area categories in the State SHSP and applicable MPO/COG strategic safety plan, and integration with the Statewide Transportation Improvement Program (STIP). A holistic evaluation of all the components unique to each location should yield the most accurate assessment of the causal factors and lead to the most effective countermeasures.

Crash Modification Factors (CMF) are shown in Appendix B

2.1.3 Road Safety Assessment (RSA) Program

MAP-21 identifies “Road Safety Audits” or “Road Safety Assessments” (RSA) as an eligible HSIP activity. An RSA is a formal examination of user safety of an existing or planned road or intersection by an independent, multi-disciplinary team. ADOT has implemented a program to conduct RSAs on state, local, and tribal roadways throughout the state.

Arizona RSA program activities include conducting RSAs, providing training, program marketing and education, and evaluating the success of the program. The RSA program manager administers and conducts RSAs throughout Arizona when requested by the road owner. HSIP funds are utilized for expenses of team members conducting RSAs and consultant participation on RSA teams. HSIP funds can also be used to implement RSA recommendations when projects are submitted by the road owner and meet HSIP eligibility requirements. Additional information, and the RSA application form, can be obtained from the ADOT Road Safety website (<http://azdot.gov/business/engineering-and-construction/traffic/traffic-safety/road-safety-assessments>).

*Web-link –
[ADOT RSA
Application](http://azdot.gov/business/engineering-and-construction/traffic/traffic-safety/road-safety-assessments)*

2.1.4 Project Prioritization

Candidate projects should be prioritized based on factors such as Benefit/Cost, potential reduction in fatal and serious injury crashes, holistic effectiveness (4 E's of

Safety), SHSP emphasis areas, FHWA focus areas for Arizona, and 9 proven countermeasures. Arizona is currently an FHWA focus state for Lane Departure, Intersection, and Pedestrian crashes.

2.1.5 HSIP Eligibility Determination

Evaluations concluding that improvements at the identified locations may significantly reduce the occurrence of fatalities and serious injuries resulting from crashes on all public roads are submitted for eligibility determination to use HSIP funds. Only those candidate projects that receive eligibility determination are considered for development as HSIP funded projects in the five-year Program.

2.2 Implementation Process

The Implementation component of Arizona's HSIP follows the ADOT LPA Project Development process. The process for safety projects is the same as for all other federal-aid projects as defined in the ADOT LPA Project Development Process Manual.

2.3 Evaluation

Arizona's HSIP includes a process for evaluation of its program and funded projects. The intent of this process is to determine the effectiveness of the Program, adherence to federal regulations, and to utilize data obtained by evaluation in the planning process. A report is submitted annually to FHWA that evaluates ADOT's HSIP in total. Before-and-after studies of safety improvement projects compare various features and characteristics of the subject location before construction and after. Information derived from the evaluation process, such as reliable CMF's and an evaluation of the efficacy and benefits of projects, are critical to the planning process and to the success of the HSIP in Arizona.

Current project eligibility requirements are detailed in Appendix A

Information from project Evaluation is critical to the success of the HSIP in Arizona

Appendix A

**HSIP Project
Application Process
and Worksheets**

UPDATED MAY 2015

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Application Framework

Introduction:

This appendix contains the instructions for submitting requests for ADOT Highway Safety Improvement Program (HSIP) funds. HSIP funds are eligible for work on any public road or publicly owned bicycle or pedestrian pathway or trail, or on tribal lands for general use of tribal members, that improves the safety for its users. Within MAP-21 there are twenty-four project categories identified as eligible as listed under 23 U.S.C § 148 (a)(4)B). The ADOT HSIP program places additional constraints on the eligibility of individual project categories in order to meet the most critical safety needs on all of Arizona's public roadways and to help ensure Arizona's MAP-21 performance targets are met.

This application is to support requests for HSIP eligibility determination for use of SFY16 HSIP funds for projects within local Obligation Authority (OA) and for SFY17 HSIP programming in the State authority as detailed below. Applicants should submit the application to their respective COG/MPO or District Engineer by the designated deadline. Applications received by ADOT TSS after close of business on the due date of **July 31, 2015** will not be accepted. After eligibility has been determined for use of HSIP funds for those projects qualifying for inclusion in the ADOT 2016 – 2019 Five-Year Transportation Facilities Construction Program, the ADOT HSIP Program Manager will rank all potential HSIP projects based on technical merits (weighted score) as outlined in this document and in the HSIP application and will submit the prioritized list to the State Engineer's Office for final ranking and approval.

In SFY17 and SFY18, ADOT's plan is to transition from set-aside money for local and state agency programs to one consolidated Arizona HSIP program for all public roadways. In order to accomplish this, certain criteria and procedures will have to be standardized in order to ensure all agencies position themselves to compete effectively in future ADOT statewide, data-driven call-for-projects. In the CY 2015 statewide call-for-projects, ADOT has taken the first steps to incorporate several of these changes and anticipates that additional changes will be needed to keep the HSIP application process consistent with lessons learned and future calls-for-projects.

The SFY Application is an excel workbook consisting of 20 tabs plus two tabs of Tables. Many of the answer blocks in the application can be filled with the dropdown options. Applicants should make sure to read the entire Application Instructions and review all of the Application Tabs before attempting to prepare and submit the application. Additional guidance and information is included in the tabs. ADOT TSS is available to answer questions or assist with additional information until the due date. The application is also available on-line at <http://azdot.gov/business/engineering-and-construction/traffic/traffic-safety/arizona-highway-safety-improvement-program>.

Application submittals at minimum must include:

1. Cover/Transmittal Letter, which must include:
 - a. How the safety issue/problem was identified
 - b. Amount of HSIP funding eligibility approval requested

- c. Identification of countermeasure(s) being installed/implemented (15 percent of the total construction estimate if the countermeasure is being used in a combined B/C ratio calculation for the total construction cost)
 - d. How the countermeasure(s) will correct the safety problem
 - e. Who is performing the work
 - f. If the work is within the agency's ROW
 - g. If utility relocation will be required
 - h. The number of fatal and serious injury crashes that can potentially be reduced by implementation of the countermeasure(s)
 - i. Identify which SHSP emphasis area the project supports
 - j. B/C ratio as calculated in the B/C ratio analysis sheet (≥ 1.5)
 - k. Weighted score as calculated in the SHSP priority spreadsheet
 - l. Source of other funds if cost of project exceeds HSIP eligibility approval or if work that is not HSIP eligible is included in the project – broken out by HSIP eligible, non-HSIP eligible and other funds (if applicable)
 - m. Commitment to maintain countermeasure(s) to standards after installation
 - n. Commitment to post-construction annual "before and after" study for 3 years
 - o. Understanding that HSIP funds can only be used once to upgrade or install a countermeasure(s) on a facility
 - p. Signature of authorized representative
2. Complete application – Incomplete applications or an application with errors will be excluded from the review and selection process. ADOT TSS will work with LPAs, COGs/MPOs and State agencies up until the final submittal date to ensure completeness. No revised applications will be considered after submittal date of **July 31, 2015**.
3. Cost estimate in ADOT format – Lump sum cost estimates will not be approved. Cost estimates need to be in enough detail for ADOT review and concurrence by Urban Project Management (UPM) or Statewide Project Management (SWPM). If more than one countermeasure is being installed, the cost of each countermeasure must be broken out. Eligibility is only approved for the total estimated cost (design and construction) of a project.
4. Crash Data Spreadsheet – All crashes associated with a given countermeasure must be within the countermeasure's influence area. Only crashes used to calculate the B/C ratio should be in the spreadsheet.
 - a. Most recent 5 years of data from the ADOT crash database. All LPAs competing for State HSIP funds must use the same database to obtain crash data.
 - b. Only fatal and serious injury crashes can be used for B/C ratio analysis or the crash data spreadsheet.
 - c. Only crashes that the proposed countermeasure will correct can be used for B/C ratio analysis or the crash data spreadsheet.
 - d. Severity of each crash must be indicated.

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- e. Manner of the collision must be indicated.
 - f. Driver behavior of Unit 1 from the ADOT Crash Form or Standard Crash Data Report Form must be indicated.
 - g. Other relevant attributes may be indicated.
 - h. Do not include crashes unreported by law enforcement unless supporting documentation, i.e. crash reports, is provided.
5. B/C Ratio calculation sheet – required for both spot and systemic projects
- a. Annual average of crashes from 4 above.
 - b. Must identify 4 or 5 star countermeasure from ADOT’s list (See Appendix B) or FHWA’s Crash Modification Factors Clearinghouse. This list is limited to the Injury Severity of Fatal, Serious and, in some cases, Minor Injury. No Property Damage Only (PDO) crashes or all inclusive crashes (All) are included. If a CMF is not available in the ADOT list, then the applicant should contact ADOT TSS prior to the application being submitted to determine if the proposed CMF and reference can be used. In no case can crash severity less than serious injury be used in the B/C ratio analysis.
 - c. Maximum of 3 countermeasures can be used in a combined crash reduction factor (CCRF).
 - d. If Crash Type, Severity and Area are all the same, then the following formula should be used: $CCRF = 1 - (1 - CRF1) \times (1 - CRF2) \times (1 - CRF3)$
 - e. If Crash Type, Severity or Area are different, then the following formula can be used:
$$CCRF = (CRF1 \times \text{no. of crashes for countermeasure1}) / (\text{total crashes})$$
$$+ (CRF2 \times \text{no. of crashes for countermeasure2}) / (\text{total crashes})$$
$$+ (CRF3 \times \text{no. of crashes for countermeasure3}) / (\text{total crashes})$$
 - f. All calculations for a CCRF must be submitted with the application.
 - g. Total countermeasure costs include design, ROW, construction, and post construction costs. For State projects, ICAP must be included in the estimate.
 - h. Annual maintenance cost must be included.
 - i. Project or Service Life can be obtained from Appendix C and must be included.
 - j. B/C ratio must be ≥ 1.5 (round to nearest tenth).
6. Vicinity Map/Location Map –Application reviewers and FHWA must be able to pinpoint the project’s location in the state and the local agency.
7. Project Limits Map – An aerial screen capture with the limits of the project outlined is recommended. These limits must concur with those identified in the Cover/Transmittal letter and the crash locations listed in the crash data spreadsheet.
8. Warrant Studies – Required when the project includes an improvement that requires an engineering study to warrant the installation of certain traffic control devices, e.g., traffic signals, pedestrian signals, etc. When applications include traffic control features like these, it is

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the applicants' responsibility to ensure all requirements of the latest MUTCD are met. Failure to include required warrants will result in the application being disqualified.

9. Non-Infrastructure (NI) Element – Applications including NI elements must be based on crash experience, crash potential, crash rate, or other safety data supported means. HSIP funding should support implementation of proven, effective activities. Implementation support should either add to existing successful non-infrastructure programs (but not replace existing funding sources), be used for new proven activities, or supplement an HSIP infrastructure safety improvement, such as enforcement on an interim basis. Non-infrastructure projects must meet all Title 23 requirements. HSIP funds cannot be used to fund regular salaries or purchase computer hardware. Programs have to specifically address safety issues identified and documented in the supporting safety data. Example: Overtime for speed enforcement to reduce crashes resulting from speeding on CR10 at MP 100.0 between 1:00 and 2:00 AM. A grant proposal must first be submitted to the appropriate agency/source for NI funding and non-acceptance prior to submitting for HSIP eligibility. The non-acceptance letter has to be included with the HSIP application. If the application for NI HSIP funding is submitted to ADOT by any agency department other than the “road owner”, then a letter is required from the road owner concurring with the application for NI HSIP funds. (See Tab 2, Application, of the excel workbook for additional guidance.)

HSIP Funding Guidelines:

1. SFY16 HSIP program funded at 80 percent State and 20 percent Local remains in place.
2. SFY17 HSIP program funded at 80 percent State and 20 percent Local remains in place. However, in SFY17 LPAs may compete for HSIP funds from the State allocation if their project estimated cost exceeds their COG/MPOs local OA and the COG/MPO agrees to return their TOTAL SFY17 HSIP OA to the State. If the project does not qualify for HSIP funding, the COG/MPO will have their local HSIP SFY17 OA reinstated. The SFY16 call-for-project is the call for COG/MPOs to submit these projects.
3. SFY18 HSIP program funded at 80 percent State and 20 percent Local remains in place and in SFY18 LPAs may compete for HSIP funds from the State allocation if their project estimated cost exceeds their COG/MPOs local OA and the COG/MPO agrees to return their TOTAL SFY18 HSIP OA to the State. If the project does not qualify for HSIP funding, the COG/MPO will have their local HSIP SFY18 OA reinstated. The SFY17 call for project is the call for COG/MPOs to submit these projects.
4. In SFY19, there will be no division of Arizona's HSIP funds. All projects submitted by LPAs, COG/MPOs and State agencies will compete on the same level for funding.
5. Minimum project total cost is \$250,000.00.

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6. HSIP funds used for right-of-way purchases are capped at 10 percent of the estimated total construction cost.
7. HSIP funds used for utility relocation or construction are capped at 10 percent of the estimated total construction cost.
8. Cost of countermeasure(s) must represent at least 15 percent of the total construction estimate if the countermeasure is being used in a combined B/C ratio calculation for the total construction cost.
9. If any HSIP eligible project exceeds the original approved amount for HSIP countermeasures, all excess costs will have to be funded through other sources i.e. STP, local, etc. (Although Detailed Engineer's Estimates are not required, accurate anticipated Cost Estimates are critical.)

General Guidelines:

1. Federal Authorization for design must be obtained within the same SFY as HSIP eligibility determination.
2. Design must begin within 6 months of the date of federal authorization for design.
3. Construction must begin within 30 months of the date of federal authorization for design.
4. If a project is included in the ADOT 2016 – 2019 Five-Year Transportation Facilities Construction Program, then federal authorization for design must be obtained within the first six months of SFY17.
5. Projects that miss design or construction milestones will be flagged and ADOT TSS will not accept applications for HSIP funding from agencies with flagged projects.
6. If an agency fails to submit necessary project documentation, such as a project close-out request letter, ADOT TSS will not accept any additional HSIP applications from that agency until such time the project document is received or closed out.
7. If a submitting agency withdraws a project because it cannot be delivered in the programmed SFY due to funding, it can be resubmitted with a revised HSIP application in the next call-for-projects for the next available funding SFY.

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
Contact:		Phone:	E-Mail:
Type of Safety Improvement:	Spot: <input type="checkbox"/> YES <input type="checkbox"/> NO	Systemic: <input type="checkbox"/> YES <input type="checkbox"/> NO	
Mark all that apply to your project: <input type="checkbox"/> PE <input type="checkbox"/> Const. <input type="checkbox"/> Procurement <input type="checkbox"/> Planning <input type="checkbox"/> Non-Infrastructure			
Anticipated Total Cost Estimate:			
Anticipated dollar amount of HSIP Funding:			
Anticipated Dollar amount of Local Match (5.7%) (5.66%):			
Anticipated Dollar amount of Other:			
Funding Source: <input type="checkbox"/> 100% HSIP <input type="checkbox"/> 94.3% HSIP <input type="checkbox"/> 94.34% HSIP		Cost Estimate Tab:	
Local Initiated Projects			
Anticipated Design Year (Construction/procurement year cannot be the same):		<input type="checkbox"/> FY16 <input type="checkbox"/> FY17 (State)	
If additional ROW is needed, what FY is purchase anticipated?:		<input type="checkbox"/> FY17 <input type="checkbox"/> FY18	
Anticipated Construction Year:		<input type="checkbox"/> FY16* <input type="checkbox"/> FY17 <input type="checkbox"/> FY18	
Administration of Project:	Agency: <input type="checkbox"/> YES <input type="checkbox"/> NO	ADOT:	<input type="checkbox"/> YES <input type="checkbox"/> NO
If competing for State Funds, COG/MPO agrees to transfer TOTAL local HSIP OA to State.			<input type="checkbox"/> YES
Name and Title of COG/MPO Representative:			
State Initiated Projects			
Anticipated Design Year (Construction/procurement year cannot be the same):		<input type="checkbox"/> FY17	
If additional ROW is needed, what FY is purchase anticipated?:		<input type="checkbox"/> FY17 <input type="checkbox"/> FY18	
Anticipated Construction Year:		<input type="checkbox"/> FY17* <input type="checkbox"/> FY18 <input type="checkbox"/> FY19 <input type="checkbox"/> FY20	
Basic Project Information			
1.	Have lower cost countermeasures been considered or implemented?		<input type="checkbox"/> YES <input type="checkbox"/> NO
1a.	If "Yes", describe: If "No", explain why not:		
2.	Describe your safety improvement project in detail: (50 words or less)		

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
2a.			
3.	Describe the location of this safety project:		
3a.			
4.	What crash data screening method was used to identify this project?		
4a.			
5.	What is the safety justification for the proposed project?		
5a.			
6.	Will there be ground disturbing activities?		<input type="checkbox"/> YES <input type="checkbox"/> NO
7.	Is project within applicants permanent ROW?		<input type="checkbox"/> YES <input type="checkbox"/> NO
7a.	If NO please explain:		
8.	Will any temporary right-of-way acquisitions be required?		<input type="checkbox"/> YES <input type="checkbox"/> NO
9.	Will there be any utility relocation needed?		<input type="checkbox"/> YES <input type="checkbox"/> NO
9a.	If YES please explain:		

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
10.	Does Section 4(f) apply to any portion of this project? <input type="checkbox"/> YES <input type="checkbox"/> NO		
10a.	If YES please explain:		
11.	Are there any other issues that may impact or delay development or construction of this project? <input type="checkbox"/> YES <input type="checkbox"/> NO		
11a.	If YES please explain:		
12.	Is this project in compliance with revised ADA Standards? <input type="checkbox"/> YES <input type="checkbox"/> NO		
12a.	If NO please explain:		
13.	Does the project support Arizona's Strategic Highway Safety Plan? <input type="checkbox"/> YES <input type="checkbox"/> NO		
14.	Are there any Studies, RSA's or Other evaluations that support this project? <input type="checkbox"/> YES <input type="checkbox"/> NO		
15.	HSIP Roadway Functional Classification:		
16.	Average Daily Traffic Volume and Year Collected:	ADT:	Year:
17.	What is the source of ADT?:		
18.	What is the posted speed limit?		
19.	Detailed engineer's cost estimate attached: <input type="checkbox"/> YES <input type="checkbox"/> NO		
"Systemic" Safety Project			
20.	Completed B/C Ratio Tabulation Sheet Attached (Required): <input type="checkbox"/> YES <input type="checkbox"/> NO		
21.	Most current 3-5 Years Crash Data from ADOT ALISS database sorted by year & severity (required): <input type="checkbox"/> YES <input type="checkbox"/> NO		
22.	What are the inclusive dates of the crash data?		
23.	If purchasing equipment or materials, who will install?	<input type="checkbox"/> Town/City <input type="checkbox"/> County <input type="checkbox"/> Contractor <input type="checkbox"/> Tribe	
24.	Does the project require proprietary Items (23CFR 635.411)? <input type="checkbox"/> YES <input type="checkbox"/> NO		
25.	Is a list of locations for systemic projects provided on the attached form? <input type="checkbox"/> YES <input type="checkbox"/> NO		
26.	How are (will) the proposed locations be prioritized for replacement? (explain below)		

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
26a.			
27.	Are the supporting structures in good condition, meet local standards and have an anticipated service life longer than the countermeasure being installed?	<input type="checkbox"/> YES <input type="checkbox"/> NO	
"Spot" Improvement Projects Only			
28.	Completed B/C Ratio Tabulation Sheet Attached (required):	<input type="checkbox"/> YES <input type="checkbox"/> NO	
29.	Most current 3-5 Years Crash Data from ADOT ALISS database sorted by year & severity (required):	<input type="checkbox"/> YES <input type="checkbox"/> NO	
30.	What are the inclusive dates of the crash data?		
31.	Have any infrastructure changes occurred within the work limits of this project during the years the crash data covers?	<input type="checkbox"/> YES <input type="checkbox"/> NO	
32.	If YES please explain:		
33.	Project vicinity map is provided:	<input type="checkbox"/> YES <input type="checkbox"/> NO	
34.	Project work limits map is provided:	<input type="checkbox"/> YES <input type="checkbox"/> NO	
SHSP - All Projects			
35.	Which SHSP Emphasis Area (EA) does this project support?:		
35a.	Which EA Strategy does it support?:		
35b.	Does this project support a second SHSP EA? If so, which EA.:		
35c.	Which EA Strategy supports the second EA?		
35d.	Does this project support a third SHSP EA? If so, which EA.:		

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
35e.	Which EA Strategy supports the third EA?		
36.	Does this project support one of the nine FHWA proven countermeasures?: <input type="checkbox"/> YES <input type="checkbox"/> NO		
36a.	If so, which countermeasure?:		
37.	Does this project support one of the three Arizona Focus Areas?: <input type="checkbox"/> YES <input type="checkbox"/> NO		
37a.	If so, which focus area?:		
38.	Which HSIP Improvement Category does this project support?:		
38a.	Which HSIP Improvement Sub-Category does this project support?:		
39.	Does your COG/MPO have a Strategic Transportation Safety Plan (STSP)?: <input type="checkbox"/> YES <input type="checkbox"/> NO		
39a.	If "YES", does this project support an Emphasis Area in the COG/MPO STSP?: <input type="checkbox"/> YES <input type="checkbox"/> NO		
39b.	List the EA:		
40.	Are any temporary safety countermeasures needed prior to this permanent solution being installed? <input type="checkbox"/> YES <input type="checkbox"/> NO		
40a.	If yes, please explain:		
B/C Ratio and Weighted Score			
41.	The calculated B/C Ratio is:		The Weighted Score is:
Non-Infrastructure Project or Element			
42.	Does the crash data for this project indicate any of the following driver/pedestrian/bicyclist behaviors contributed to the identification of this project location?		
42a.	Impaired Driving (Alcohol or Drug)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Occupant Protection	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Pedestrian and Bicycle Safety	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Motorcycle Safety	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Police Traffic Services/Speed Control	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Lack of accurate/complete crash data	<input type="checkbox"/> YES	<input type="checkbox"/> NO
42a.	Emergency Medical Services	<input type="checkbox"/> YES	<input type="checkbox"/> NO

ADOT FY16 HIGHWAY SAFETY IMPROVEMENT PROGRAM APPLICATION

Agency:		Title of Project:	
County:		COG/MPO:	
District:		HSIP Funds:	<input type="checkbox"/> STATE <input type="checkbox"/> LOCAL
42b.	If "YES" to any of the above, has a grant proposal been submitted to any other agency/source for funding for the non-infrastructure portion of this project? <input type="checkbox"/> YES <input type="checkbox"/> NO 		
42b.	If "NO", then explain why other sources have not been explored. <div style="height: 40px; border: 1px solid black; margin-top: 5px;"></div>		
42b.	If "YES", then a copy of the proposal and disapproval must be submitted as an attachment.		
42c.	Is a letter attached from the agency department, i.e. PD, implementing this NI element if the agency is different from the "road owner"? <input type="checkbox"/> YES <input type="checkbox"/> NO 		

ARIZONA HIGHWAY SAFETY IMPROVEMENT PROGRAM

Required for all HSIP Applications					
Agency:		Title of Project:	0		
Benefit / Cost Ratio Tabulation					
Annual Benefit Tabulation					
Severity	Annual Average	Estimated CMF* Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	0.00	0%	0.00	\$5,800,000	\$0
Incapacitating Injury	0.00	0%	0.00	\$400,000	\$0
Total Annual Benefits					\$0
Costs					
Total Project Cost					\$0
Project Life (years)					0
Interest Rate (%)					0%
Capital Recovery Factor					0.0000
Annual Construction Cost					\$0
Annual Maintenance Cost					\$0.00
Total Annual Costs					\$0
Benefit / Cost					
Annual Benefit	Annual cost			Benefit / Cost Ratio	
\$0	\$0			0.0	
*REQUIRED: Use 4 and 5 star CMF's from ADOT Lists at Tabs 16 - 18 preferred.					

The Cost Estimate shown on the next page is just one example of several possibilities for HSIP funding depending on HSIP Funding Share, non-HSIP funds, other funds, etc. However, as a minimum all cost estimates have to be submitted in this format. It is recommended that a detailed Engineer Estimate and cost breakdown also be included since the applicant is responsible for all funds exceeding the original approved HSIP eligibility.

HIGHWAY SAFETY IMPROVEMENT PROGRAM
APPLICATION - COST ESTIMATE

Agency:	Name of Project:	Procurement of Sign Panels - Local Agency Staff Installs						
HSIP Project Cost Estimate Worksheet								
Project Cost Estimate:	Description:	Quantity:	Cost (Unit):	Total Cost	HSIP:	Local Match:	Other Amt:	TOTAL COST
					100.00%	0.00%	0.00%	
Planning or Study:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Preliminary Engineering:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
ADOT Admin Costs:		1	\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ -	\$ -	\$ 30,000.00
Sub-Total			\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ -	\$ -	\$ 30,000.00
Materials:	RWM Signs (SF)	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials:	Mounting Hardware (ea)	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials:		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Materials Sub-Total:			\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Sales Tax		10.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Sub-Total			\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Construction Admin :		14.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Contingencies :		5.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Post Design:		1.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
		0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Sub-Total			\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
TOTAL REQUEST					\$ 30,000.00	\$ -	\$ -	\$ 30,000.00

Comments:

Appendix B

Crash Modification Factors

UPDATED MAY 2015

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ARIZONA HIGHWAY SAFETY IMPROVEMENT PROGRAM

The following tables contain preferred Crash Modification Factors from the “CMF Clearinghouse” and from “Countermeasures that Work.” These CMF’s have a Star Quality Rating of 4 or 5 for fatal and serious injury Crash Severity and should be used when calculating the B/C for HSIP projects. For guidance when calculating a B/C for countermeasures not listed, contact the ADOT Traffic Safety Section.

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
5452	Access management		Convert an open median to a directional median	0.76	All	Fatal, Serious injury	Principal Arterial Other	Urban and suburban	4	Roadway with full median openings	Annual Average Daily Traffic	27,000	96,000					4,6,8				40-55 mph	Not Specified	Divided by Median
5453	Access management		Convert an open median to a directional median	0.77	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Urban and suburban	4	Roadway with full median openings	Annual Average Daily Traffic	27,000	96,000					4,6,8				40-55 mph	Not Specified	Divided by Median
5454	Access management		Convert an open median to a directional median	0.82	All	Serious injury	Principal Arterial Other	Urban and suburban	4	Roadway with full median openings	Annual Average Daily Traffic	27,000	96,000					4,6,8				40-55 mph	Not Specified	Divided by Median
4675	Access management		Decrease freeway ramp spacing from infinity to S (ft) with/without auxiliary lane		Not Specified	Fatal, Serious injury, Minor injury	Principal Arterial Interstate	Not Specified	4	Ramp spacing approaching infinity, which represents a basic freeway segment with no ramps.	Average Daily Traffic (ADT)	5,134	153,500					Var.				Var.	Not Specified	Divided by Median
302	Access management	Other	Increase intersection median width by 3 ft increments	0.96	Multiple vehicle	Fatal, Serious injury, Minor injury	Not Specified	Rural	5		Not Specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
3035	Access management		Install raised median	0.56	All	Fatal, Serious injury	Not Specified		4	No raised median	Average Daily Traffic (ADT)	10,000	55,000										All	Divided by Median
21	Access management		Provide a raised median	0.61	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4									2						
4583	Advanced technology and ITS		Implement automated speed enforcement cameras	0.83	All	Fatal, Serious injury, Minor injury	All	All	5	No automated speed enforcement	Annual Average Daily Traffic													
4142	Advanced technology and ITS		Install automated section speed enforcement system	0.44	All	Fatal, Serious injury	Principal Arterial Other Freeways and Expressways	Not Specified	4	No automated section speed enforcement system	Annual Average Daily Traffic (AADT)	23,000	42,000					6				130 km/h	All	Divided by Median
4673	Advanced technology and ITS		Install automated speed camera at signalized intersection	0.76	Speed related	Serious injury, Minor injury	Not Specified	Not Specified	4	Signalized intersection with no automated speed enforcement camera.									Roadway/roadway (not interchange related)	No values chosen	Signalized		All	
3860	Advanced technology and ITS		Install red-light camera (red light running crashes)	0.76	All	Fatal	Not Specified	Urban	4	Absence of red-light cameras									Not Specified	Not Specified	Signalized		All	
3861	Advanced technology and ITS		Install red-light cameras at intersections	0.83	All	Fatal	Not Specified	Urban	4	Absence of red-light camera									Not Specified	Not Specified	Signalized		All	
4741	Delineation	Visibility of existing markings	Install wider edgelines (4 in to 6 in)	0.585	Day time	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	4 in wide edgelines								2					Day	
4746	Delineation	Visibility of existing markings	Install wider edgelines (4 in to 6 in)	0.632	Single vehicle	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	4 in wide edgelines								2					All	
4737	Delineation	Visibility of existing markings	Install wider edgelines (4 in to 6 in)	0.635	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	4 in wide edgelines								2					All	
4748	Delineation	Visibility of existing markings	Install wider edgelines (4 in to 6 in)	0.813	Nighttime, Single vehicle	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	4 in wide edgelines								2					Night	
4742	Delineation	Visibility of existing markings	Install wider edgelines (4 in to 6 in)	0.873	Nighttime	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	4 in wide edgelines								2					Night	
4790	Delineation	Visibility of existing markings	Install wider markings and both edgeline and centerline rumble strips with resurfacing	0.62	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							2					All	Undivided
4781	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.74	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4777	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.75	All	Fatal, Serious injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4780	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.76	All	Fatal, Serious injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4778	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.76	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
4782	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.86	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4779	Delineation	Visibility of existing markings	Install wider markings and edgeline rumble strips with resurfacing	0.9	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Urban	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4783	Delineation	Visibility of existing markings	Install wider markings and shoulder rumble strips with resurfacing	0.74	All	Fatal, Serious injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4787	Delineation	Visibility of existing markings	Install wider markings and shoulder rumble strips with resurfacing	0.75	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4784	Delineation	Visibility of existing markings	Install wider markings and shoulder rumble strips with resurfacing	0.77	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4785	Delineation	Visibility of existing markings	Install wider markings and shoulder rumble strips with resurfacing	0.8	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Urban	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4776	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.62	All	Fatal, Serious injury	Not Specified	Urban	4		Average Daily Traffic (ADT)							2					All	Undivided
4770	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.66	All	Fatal, Serious injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4771	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.75	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4767	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.79	All	Fatal, Serious injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4768	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.91	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4775	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.92	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)							multi					All	Undivided
4769	Delineation	Visibility of existing markings	Install wider markings with resurfacing	0.96	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Urban	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
4792	Delineation	Visibility of existing markings	Install wider markings WITHOUT resurfacing	0.78	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)							multi					All	Divided by Median
2361	Highway lighting		Full to partial interchange lighting	0.913	All	Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Suburban	4	Full interchange lighting.	Annual Average Daily Traffic (AADT)								Roadway/roadway (interchange ramp terminal)		Uncontrolled		Day	
578	Highway lighting		Illumination	0.69	All	Serious injury, Minor injury	All	Urban	4			Not Specified	Not Specified											
581	Highway lighting		Illumination	0.73	All	Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	All	4			Not Specified	Not Specified											
441	Highway lighting		Provide intersection illumination	0.41	Vehicle/pedestrian	Serious injury, Minor injury	Not Specified	Not Specified	4		Not specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	Not Specified	Not Specified			
5228	Intersection geometry	Intersection geometry reconfiguration	Conversion of intersection into low-speed roundabout	0.473	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	The intersection was operating under no control, yield, TWSC, AWSC, or signal control.	Annual Average Daily Traffic (AADT)			4,100 (total entering)	4,8100 (total entering)			2,4	Roadway/roadway (not interchange related)	3-leg, 4-leg	Other		All	All
4927	Intersection geometry	Intersection geometry reconfiguration	Conversion of intersection into multi-lane roundabout	0.367	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	The intersection was operating under no control, yield, TWSC, AWSC, or signal control.	Annual Average Daily Traffic (AADT)			4,100 (Total)	4,8100 (Total)			4	Roadway/roadway (not interchange related)	3-leg, 4-leg	Other		All	All

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
4195	Intersection geometry	Intersection geometry reconfiguration	Conversion of signalized intersection into single- or multi-lane roundabout	0.29	All	Serious injury, Minor injury	Not Specified	Urban and suburban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,300	52,500			2	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout	15-35 mph	All	
210	Intersection geometry	Intersection geometry reconfiguration	Conversion of stop-controlled intersection into single-lane roundabout	0.12	All	Serious injury, Minor injury	Not Specified	Urban	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	Not Specified	Stop-controlled			
211	Intersection geometry	Intersection geometry reconfiguration	Conversion of stop-controlled intersection into single-lane roundabout	0.18	All	Serious injury, Minor injury	Not Specified	Rural	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	Not Specified	Stop-controlled			
4931	Intersection geometry	Intersection geometry reconfiguration	Conversion of two-way stop-controlled intersection into single- or multi-lane roundabout	0.65	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	The intersection was operating under TWSC control.	Annual Average Daily Traffic (AADT)			4,100 (total entering)	4,8100 (total entering)			2,4	Roadway/roadway (not interchange related)	3-leg, 4-leg	Stop-controlled		All	All
4700	Intersection geometry		Convert high-speed rural intersection (4 leg) to roundabout	0.11	All	Serious injury, Minor injury	Not Specified	Rural	4	4 leg intersection	Annual Average Daily Traffic (AADT)							1	Roadway/roadway (not interchange related)	4-leg	Roundabout	40-65 mph		
4698	Intersection geometry		Convert high-speed rural intersection (4 leg) to roundabout	0.12	All	Serious injury, Minor injury	Not Specified	Rural	4	4 leg intersection	Annual Average Daily Traffic (AADT)							2-Jan	Roadway/roadway (not interchange related)	4-leg	Roundabout	40-65 mph		
4696	Intersection geometry	Intersection geometry reconfiguration	Convert high-speed rural intersection to roundabout	0.13	All	Serious injury, Minor injury	Not Specified	Rural	4	Stop controlled intersection (3 or 4 leg)	Annual Average Daily Traffic (AADT)							2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout	40-65 mph		
4259	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.259	All	Fatal, Serious injury, Minor injury	Not Specified	Suburban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,322	43,123			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout		Not Specified	
4187	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.26	All	Serious injury, Minor injury	Not Specified	Suburban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,300	52,500			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout	15-35 mph	All	
4255	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.288	All	Fatal, Serious injury, Minor injury	Not Specified	Urban and suburban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,322	43,123			2	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout		Not Specified	
4185	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.34	All	Serious injury, Minor injury	Not Specified	Urban and suburban	4	Signalized intersection	Average Daily Traffic (ADT)			5,300	52,500			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout	15-35 mph	All	
4193	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.34	All	Serious injury, Minor injury	Not Specified	Urban and suburban	4	Signalize intersection (4 leg)	Annual Average Daily Traffic (AADT)			5,300	52,500			2-Jan	Roadway/roadway (not interchange related)	4-leg	Roundabout	15-35 mph	All	
4253	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.342	All	Fatal, Serious injury, Minor injury	Not Specified	Urban and suburban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,322	43,123			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout		Not Specified	
4261	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.445	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Signalized intersection	Annual Average Daily Traffic (AADT)			5,322	43,123			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout		Not Specified	
4189	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.45	All	Serious injury, Minor injury	Not Specified	Urban	4	Signalized intersection	Average Daily Traffic (ADT)			5,300	52,500			2-Jan	Roadway/roadway (not interchange related)	3-leg, 4-leg	Roundabout	15-35 mph	All	
214	Intersection geometry	Intersection geometry reconfiguration	Convert signalized intersection to modern roundabout	0.68	All	Serious injury, Minor injury	Not Specified	Not Specified	4		Not specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	Not Specified	Signalized			
213	Intersection geometry	Intersection geometry reconfiguration	Convert to roundabout	0.61	All	Serious injury, Minor injury	Not Specified	Not Specified	4		Not specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	Not Specified	Not Specified			
215	Intersection geometry	Intersection geometry reconfiguration	Convert unsignalized intersection to roundabout	0.56	All	Serious injury, Minor injury	Not Specified	Not Specified	4		Not specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	Not Specified	Signalized			
294	Intersection geometry	Turn lanes	Painted channelization of both major and minor roads	0.43	All	Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)								Roadway/roadway (not interchange related)	4-leg	Not Specified			
292	Intersection geometry	Turn lanes	Physical channelization of both major and minor roads	0.73	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)								Roadway/roadway (not interchange related)	4-leg	Not Specified			

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
272	Intersection geometry	Turn lanes	Provide a left-turn lane on both major-road approaches	0.42	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	5		Average Daily Traffic (ADT)			1,500	32,400	50	11,800		Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
273	Intersection geometry	Turn lanes	Provide a left-turn lane on both major-road approaches	0.5	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)			1,500	40,600	200	8,000		Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
275	Intersection geometry	Turn lanes	Provide a left-turn lane on both major-road approaches	0.52	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)			4,600	40,300	100	13,700		Roadway/roadway (not interchange related)	4-leg	Signalized			
274	Intersection geometry	Turn lanes	Provide a left-turn lane on both major-road approaches	0.83	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	5		Average Daily Traffic (ADT)			7,200	55,100	550	2,600		Roadway/roadway (not interchange related)	4-leg	Signalized			
255	Intersection geometry	Turn lanes	Provide a left-turn lane on one major-road approach	0.45	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)			1,600	32,400	50	11,800		Roadway/roadway (not interchange related)	3-leg	Stop-controlled			
264	Intersection geometry	Turn lanes	Provide a left-turn lane on one major-road approach	0.65	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	5		Average Daily Traffic (ADT)			1,600	32,400	50	11,800		Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
265	Intersection geometry	Turn lanes	Provide a left-turn lane on one major-road approach	0.71	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	5		Average Daily Traffic (ADT)			1,500	40,600	200	8,000		Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
267	Intersection geometry	Turn lanes	Provide a left-turn lane on one major-road approach	0.72	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)			4,600	40,300	100	13,700		Roadway/roadway (not interchange related)	4-leg	Signalized			
266	Intersection geometry	Turn lanes	Provide a left-turn lane on one major-road approach	0.91	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	5		Average Daily Traffic (ADT)			7,200	55,100	550	2,600		Roadway/roadway (not interchange related)	4-leg	Signalized			
287	Intersection geometry	Turn lanes	Provide a right-turn lane on one major-road approach	0.77	All	Fatal, Serious injury, Minor injury	Not Specified	All	4		Average Daily Traffic (ADT)			1,500	40,600	25	26,000		Roadway/roadway (not interchange related)	3-leg, 4-leg	Stop-controlled			
288	Intersection geometry	Turn lanes	Provide a right-turn lane on one major-road approach	0.91	All	Fatal, Serious injury, Minor injury	Not Specified	All	5		Average Daily Traffic (ADT)			7,200	55,100	550	8,400		Roadway/roadway (not interchange related)	3-leg, 4-leg	Signalized			
4578	Intersection traffic control		Change left-turn phase from permissive to protected/permissive or permissive/protected phasing on one or more approaches	0.84	Left turn	Fatal, Serious injury, Minor injury	Not Specified	Urban	5	Permitted phasing	Annual Average Daily Traffic (AADT)			3,000	77,000	1	45,500		Roadway/roadway (not interchange related)	4-leg	Signalized			
4269	Intersection traffic control		Change permissive left-turn phasing to protected/permissive	0.962	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Permissive phasting	Annual Average Daily Traffic (AADT)			4,857	74,990	1,466	42,723		Roadway/roadway (not interchange related)	4-leg	Signalized		Not Specified	
4169	Intersection traffic control		Changing left turn phasing on more than one approach from permissive to protected-permissive	0.914	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Permissive only left turn phasing on all treated approaches	Annual Average Daily Traffic (AADT)			4,857	74,990	1,466	42,723		Roadway/roadway (not interchange related)	4-leg	Signalized		Not Specified	
4165	Intersection traffic control		Changing left turn phasing on one approach from permissive to protected-permissive	0.995	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Permissive only left turn phasing on the treated approach	Annual Average Daily Traffic (AADT)			4,857	74,990	1,466	42,723		Roadway/roadway (not interchange related)	4-leg	Signalized		Not Specified	
3128	Intersection traffic control	Traffic control type	Convert minor-road stop control to all-way stop control	0.23	All	Fatal, Serious injury, Minor injury	All	All	4	Two-way stop sign control with and without flashing beacons.				680	15,400	680	15,400	1	Roadway/roadway (not interchange related)	4-leg	Stop-controlled	25-55	Not Specified	All
3131	Intersection traffic control	Traffic control type	Convert two-way (without flashing beacons) to all-way stop control (without flashing beacons)	0.276	All	Fatal, Serious injury, Minor injury	All	All	4	Two-way stop sign control without flashing beacons.				680	15,100	680	15,100	1	Roadway/roadway (not interchange related)	4-leg	Stop-controlled	25-55	Not Specified	Undivided
4111	Intersection traffic control		Improve signal visibility, including signal lens size upgrade, installation of new back-plates, addition of reflective tapes to existing back-plates, and installation of additional signal heads	0.902	Nighttime	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Smaller signal lens size, old back-plates, no reflective tapes on existing back-plates, and less number of signal heads	Average Daily Traffic (ADT)			4,637	51,743	134	48,906	4-Mar	Roadway/roadway (not interchange related)	4-leg	Signalized	50 km/h	Night	

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1431	Intersection traffic control	Traffic control visibility	Improve visibility of signal heads	0.97	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	Improvements included one or more of the following: signal lens size upgrade, installing new backboards, adding reflective tapes to existing backboards, and installing additional signal heads.									Roadway/roadway (not interchange related)	4-leg	Signalized	50 km/h (30 mph)	All	
320	Intersection traffic control	Traffic control type	Install a traffic signal	0.33	Angle	Fatal, Serious injury, Minor injury	Not Specified	Urban	4		Average Daily Traffic (ADT)								Roadway/roadway (not interchange related)	4-leg	Stop-controlled			
5534	Intersection traffic control	Traffic control type	Install a traffic signal	0.684	All	Fatal, Serious injury, Minor injury	Not Specified	Not Specified	4	Stop controlled intersection	Annual Average Daily Traffic (AADT)			35,000				4-Feb	Roadway/roadway (not interchange related)	3-leg, 4-leg	Stop-controlled		Not Specified	
4201	Intersection traffic control		Install dynamic signal warning flashers	0.82	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	Signalized intersection without advance warning flashers.	Annual Average Daily Traffic (AADT)			7,500	99,000	40	20,100		Roadway/roadway (not interchange related)	3-leg, 4-leg	Signalized		All	
4855	Intersection traffic control	Traffic control visibility	Installation of an actuated advance warning dilemma zone protection system at high-speed signalized intersections	0.887	All	Serious injury, Minor injury	Not Specified	Not Specified	4	Untreated signalized intersection	Annual Average Daily Traffic (AADT)			2,420	21,477	995	8,948		Roadway/roadway (not interchange related)	4-leg	Signalized		All	
4888	Intersection traffic control	Signal phasing or timing	Replace Night-Time Flash with Steady Operation	0.47	All	Fatal, Serious injury, Minor injury	All	All	4	Traffic signals were operating in the late night flash (LNF) mode from late night to early morning hours.	Annual Average Daily Traffic (AADT)			2,550	59,000	1,000	23,333		Not specified	3-leg, 4-leg	Signalized		Night	All
156	On-street parking		Prohibit on-street parking	0.65	All	Serious injury, Minor injury	Principal Arterial Other	Urban	4		Annual Average Daily Traffic (AADT)													
4574	On-street parking		Prohibit on-street parking	0.78	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Urban	5	Provision of on-street parking	Annual Average Daily Traffic (AADT)	30,000	40,000											
153	On-street parking		Prohibit on-street parking	0.8	All	Serious injury, Minor injury	Minor Arterial	Urban	5			Not Specified	Not Specified											
41	Roadside	Roadside barriers	Change barrier along embankment to less rigid type	0.68	Run off road	Serious injury, Minor injury	Not Specified	Not Specified	4			Not Specified	Not Specified											
26	Roadside	Clear zone	Flatten sideslope from 1V:3H to 1V:4H	0.58	All	Serious injury, Minor injury	Not Specified	Rural	5			Not Specified	Not Specified					2						
29	Roadside	Clear zone	Flatten sideslope from 1V:4H to 1V:6H	0.78	All	Serious injury, Minor injury	Not Specified	Rural	5			Not Specified	Not Specified					2						
42	Roadside	Median barriers	Install any type of median barrier	0.57	All	Fatal	Principal Arterial Other	Rural	4			20,000	60,000					Multilane						Divided
38	Roadside	Roadside barriers	New guardrail along embankment	0.53	Run off road	Serious injury, Minor injury	Not Specified	Not Specified	5			Not Specified	Not Specified											
37	Roadside	Roadside barriers	New guardrail along embankment	0.56	Run off road	Fatal	Not Specified	Not Specified	4			Not Specified	Not Specified											
5639	Roadway		Convert traditional mainline toll plazas to hybrid mainline toll plazas	0.54	All	Fatal, Serious injury	Principal Arterial Other	All	4	Traditional mainline toll plazas													All	
1928	Roadway	Lane restrictions	Implement truck lane restrictions on multilane freeways	0.99	Truck related	Fatal, Serious injury, Minor injury	Principal Arterial Interstate		4	No truck restrictions		17,049	74,079					2					All	
1931	Roadway	Lane restrictions	Implement truck lane restrictions on multilane freeways	0.6	Truck related	Fatal, Serious injury, Minor injury	Principal Arterial Interstate		4	No truck restrictions		17,049	74,079					2					All	

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1929	Roadway	Lane restrictions	Implement truck lane restrictions on multilane freeways	0.68	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways		4	No truck restrictions		17,049	74,079					2					All	
2420	Roadway	Roadway rumble strips	Install centerline and shoulder rumble strips	0.82	All	Fatal, Serious injury	Principal Arterial Other	Rural	4									4-Feb					All	All
3357	Roadway	Roadway rumble strips	Install centerline rumble strips	0.55	Head on, Sideswipe	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	1,336	13,240					2					All	Undivided
3360	Roadway	Roadway rumble strips	Install centerline rumble strips	0.55	Head on, Sideswipe	Fatal, Serious injury, Minor injury	Not Specified	Rural	5	No centerline rumble strips	Average Daily Traffic (ADT)	574	20,784					2					All	Undivided
3358	Roadway	Roadway rumble strips	Install centerline rumble strips	0.56	Head on, Sideswipe	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	574	17,591					2					All	Undivided
5401	Roadway	Roadway rumble strips	Install centerline rumble strips	0.66	All	Fatal, Serious injury, Minor injury	All	Rural	4	No centerline rumble strips	Annual Average Daily Traffic (AADT)	200	8,000					2					All	Undivided
3347	Roadway	Roadway rumble strips	Install centerline rumble strips	0.78	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	1,336	13,240					2					All	Undivided
3362	Roadway	Roadway rumble strips	Install centerline rumble strips	0.88	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	5	No centerline rumble strips	Average Daily Traffic (ADT)	574	20,784					2					All	Undivided
3346	Roadway	Roadway rumble strips	Install centerline rumble strips	0.91	All	Fatal, Serious injury, Minor injury	Not Specified	Urban	4	No centerline rumble strips	Average Daily Traffic (ADT)	2,338	22,076					2					All	Undivided
3350	Roadway	Roadway rumble strips	Install centerline rumble strips	0.91	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	5	No centerline rumble strips	Average Daily Traffic (ADT)	574	20,784					2					All	Undivided
3348	Roadway	Roadway rumble strips	Install centerline rumble strips	0.94	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	574	17,591					2					All	Undivided
3368	Roadway	Roadway rumble strips	Install centerline rumble strips on horizontal curves	0.63	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	1,336	13,240					2					All	Undivided
3371	Roadway	Roadway rumble strips	Install centerline rumble strips on horizontal curves	0.94	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	574	20,784					2					All	Undivided
3381	Roadway	Roadway rumble strips	Install centerline rumble strips on tangent sections	0.78	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	574	17,591					2					All	Undivided
3380	Roadway	Roadway rumble strips	Install centerline rumble strips on tangent sections	0.82	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	No centerline rumble strips	Average Daily Traffic (ADT)	1,336	13,240					2					All	Undivided
3383	Roadway	Roadway rumble strips	Install centerline rumble strips on tangent sections	0.85	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	5	No centerline rumble strips	Average Daily Traffic (ADT)	574	20,784					2					All	Undivided
3396	Roadway	Roadway rumble strips	Install edgeline rumble strips	0.61	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3394	Roadway	Roadway rumble strips	Install edgeline rumble strips	0.67	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3404	Roadway	Roadway rumble strips	Install edgeline rumble strips on roadways with a shoulder width of 5 feet or greater	0.34	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	Roadway with no rumble strips and a shoulder width less than 5 feet	Average Daily Traffic (ADT)	4,956	31,692										All	Divided by Median
3408	Roadway	Roadway rumble strips	Install edgeline rumble strips on roadways with a shoulder width of 5 feet or greater	0.57	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	Roadway with no rumble strips and a shoulder width less than 5 feet	Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
4083	Roadway		Install periodic passing lanes on rural two-lane highways	0.58	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Two-lane rural highway with no passing lane	Annual Average Daily Traffic (AADT)	1,655	7,031					2					All	Undivided

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4082	Roadway		Install periodic passing lanes on rural two-lane highways	0.65	Non-intersection	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Two-lane rural highway with no passing lane	Annual Average Daily Traffic (AADT)	1,655	7,031					2					All	Undivided
5397	Roadway	Roadway rumble strips	Install rectangular shaped centerline rumble strips	0.689	All	Fatal, Serious injury, Minor injury	All	Rural	4	No centerline rumble strips	Annual Average Daily Traffic (AADT)	200	8,000					2					All	Undivided
2705	Roadway	Roadway rumble strips	Install transverse rumble strips on stop controlled approaches in rural areas	0.745	All	Fatal, Serious injury	Major Collector	All	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	4-leg	Stop-controlled		All	Undivided
2709	Roadway	Roadway rumble strips	Install transverse rumble strips on stop controlled approaches in rural areas	0.785	All	Fatal, Serious injury	Major Collector	Rural	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	3-leg,4-leg	Stop-controlled		All	Undivided
2704	Roadway	Roadway rumble strips	Install transverse rumble strips on stop controlled approaches in rural areas	0.913	All	Fatal, Serious injury, Minor injury	Major Collector	Rural	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	4-leg	Stop-controlled		All	Undivided
2708	Roadway	Roadway rumble strips	Install transverse rumble strips on stop controlled approaches in rural areas	0.987	All	Fatal, Serious injury, Minor injury	Major Collector	Rural	4		Annual Average Daily Traffic (AADT)								Roadway/roadway (not interchange related)	3-leg,4-leg	Stop-controlled		All	Undivided
2342	Roadway	Number of lanes	Install TWLTL (two-way left turn lane) on two lane road	0.629	All	Fatal, Serious injury, Minor injury	Not Specified	All	4		Annual Average Daily Traffic (AADT)	8,500	22,500					2					All	Divided by TWLTL
2343	Roadway	Number of lanes	Install TWLTL (two-way left turn lane) on two lane road	0.725	All	Fatal, Serious injury, Minor injury	Not Specified	All	4									2					All	Divided by TWLTL
2346	Roadway	Number of lanes	Install TWLTL (two-way left turn lane) on two lane road	0.739	All	Fatal, Serious injury, Minor injury	Not Specified	All	5									2					All	Divided by TWLTL
584	Roadway	Number of lanes	Introduce TWLTL (two-way left turn lanes) on rural two lane roads	0.65	All	Serious injury, Minor injury	Not Specified	Rural	4			Not Specified	Not Specified					2						
4958	Roadway	Other	Removing mainline barrier toll plazas on highways	0.597	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Not Specified	4	11 mainline toll plazas existed on the Gardens State Parkway (GSP) in New Jersey.	Annual Average Daily Traffic (AADT)							7-Feb					Not specified	Divided by Median
2976	Roadway	Pavement condition and friction	Resurface pavement	0.95	All	Fatal, Serious injury	Not Specified		4														All	
3561	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.53	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3550	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.6	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3457	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.63	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	948	9,067					2					All	Undivided
3502	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.63	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776										All	Divided by Median
3454	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.64	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	5		Average Daily Traffic (ADT)	782	10,386					2					All	Undivided
3478	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.72	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3433	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.82	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	948	9,067					2					All	Undivided
3447	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.83	Run off road	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	5		Average Daily Traffic (ADT)	6,777	37,112										All	Divided by Median
3422	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.84	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Urban	4		Average Daily Traffic (ADT)	11,254	59,391										All	Divided by Median

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
3448	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.84	Run off road	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)	11,539	37,112										All	Divided by Median
3425	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.87	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)	6,777	24,752										All	Divided by Median
3426	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.9	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	4,959	20,763										All	Divided by Median
3430	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.92	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	782	10,386					2					All	Undivided
3423	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.93	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)	6,777	37,112										All	Divided by Median
3446	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.93	Run off road	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Urban	4		Average Daily Traffic (ADT)	11,254	59,391										All	Divided by Median
3424	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.94	All	Fatal, Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	4		Average Daily Traffic (ADT)	11,539	37,112										All	Divided by Median
3428	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.95	All	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	5,326	20,763										All	Divided by Median
3450	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips	0.97	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	4,959	20,763										All	Divided by Median
3627	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips on roadways with a shoulder width equal to 5 feet	0.46	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4	Roadway with no rumble strips and a shoulder width less than 5 feet	Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3637	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips with an offset of 0-8 inches relative to the edgeline	0.67	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
3651	Shoulder treatments	Shoulder rumble strips	Install shoulder rumble strips with an offset of 9-20 inches relative to the edgeline	0.62	Run off road	Fatal, Serious injury, Minor injury	Not Specified	Rural	4		Average Daily Traffic (ADT)	180	12,776					2					All	Undivided
4362	Shoulder treatments		Installation of safety edge treatment	0.769	Run off road	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	397	18,697					2					All	
4397	Shoulder treatments		Installation of safety edge treatment	0.784	Other	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	397	18,697					2					All	
4323	Shoulder treatments		Installation of safety edge treatment	0.835	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	397	18,697					2					All	
4314	Shoulder treatments		Installation of safety edge treatment	0.89	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	397	18,697					2					All	
4399	Shoulder treatments		Installation of safety edge treatment	0.953	Other	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	310	18,697					2					All	
4326	Shoulder treatments		Installation of safety edge treatment	0.983	All	Fatal, Serious injury, Minor injury	Principal Arterial Other	Rural	4	Rural highways prior to resurfacing and installation of safety edge treatment	Annual Average Daily Traffic (AADT)	310	18,697					2					All	
2450	Signs		Advance street name signs	0.99	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	No advance signs at a signalized intersection									Roadway/roadway (not interchange related)	3-leg, 4-leg	Signalized		All	
4918	Signs		Install a "Vehicles Entering When Flashing" (VEWF) system (advance post mounted signs on major and loops on minor)	0.73	All	Fatal, Serious injury, Minor injury	Not Specified	All	4	stop-controlled	Annual Average Daily Traffic (AADT)				3,000	30,000		2	Roadway/roadway (not interchange related)	4-leg	Stop-controlled	45-55 mph		

CMF ID	Countermeasure Category	Countermeasure Subcategory	Countermeasure	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Star Quality Rating	Prior Condition	Traffic Volume Unit	Minimum Traffic Volume (non-intersection)	Maximum Traffic Volume (non-intersection)	Minimum Major Road Traffic Volume (intersection)	Maximum Major Road Traffic Volume (intersection)	Minimum Minor Road Traffic Volume (intersection)	Maximum Minor Road Traffic Volume (intersection)	Number of Lanes	Intersection Type	Intersection Geometry	Traffic Control Type	Speed Limit (mph)	Crash Time of Day	Roadway Division Type
2438	Signs		Install chevron signs on horizontal curves	0.84	Non-intersection	Fatal, Serious injury, Minor injury	All	Rural	4	No sign	Annual Average Daily Traffic (AADT)	261	14,790					2					All	Undivided
2433	Signs		Install new fluorescent curve signs or upgrade existing curve signs to fluorescent sheeting	0.75	Non-intersection	Fatal, Serious injury, Minor injury	All	Rural	4	No sign or sign without fluorescent sheeting	Annual Average Daily Traffic (AADT)	895	20,479					2					All	Undivided
144	Speed management		10% reduction in mean speed	0.68	All	Fatal	All	All	4			All	All											
145	Speed management		10% reduction in mean speed	0.85	All	Serious injury, Minor injury	All	All	5			All	All											
147	Speed management		15% reduction in mean speed	0.56	All	Fatal	All	All	4			All	All											
148	Speed management		15% reduction in mean speed	0.78	All	Serious injury, Minor injury	All	All	4			All	All											
141	Speed management		5% reduction in mean speed	0.83	All	Fatal	All	All	5			All	All											
142	Speed management		5% reduction in mean speed	0.93	All	Serious injury, Minor injury	All	All	5			All	All											
134	Speed management		Install speed humps	0.5	All	Serious injury, Minor injury	Local	Urban and Suburban	4			Not Specified	Not Specified					2						
132	Speed management		Install speed humps	0.6	All	Serious injury, Minor injury	Local	Urban and Suburban	4			Not Specified	Not Specified					2						
139	Speed management		Install transverse rumble strips as traffic calming device	0.64	All	Serious injury, Minor injury	Local	Urban and Suburban	4			Not Specified	Not Specified					2						
129	Speed management		Traffic calming	0.67	All	Serious injury, Minor injury	Minor Collector	Urban	4		Average Daily Traffic (ADT)							2						
131	Speed management		Traffic calming	0.67	All	Serious injury, Minor injury	Minor Collector	Urban	4		Average Daily Traffic (ADT)							2						
406	Speed management		Transverse bar pavement marking at roundabout approaches	0.43	Speed related	Serious injury, Minor injury	Not Specified	Not Specified	4		Not Specified			Not Specified	Not Specified				Roadway/roadway (not interchange related)	Not specified	Roundabout			

Countermeasure	CMF	Expected Reduction of Crashes	Expected Reduction of Fatalities	Star Rating	Additional Information	Resource Page number
High visibility sobriety checkpoints	0.85	10-30%	0.15	5		Countermeasures That Work - NHTSA - Pg 35
High visibility saturation patrols				4		Countermeasures That Work - NHTSA - Pg 37
Preliminary Breath Test Devices (PBTs)				4	Proven for increasing arrests	Countermeasures That Work - NHTSA - Pg 38
Passive alcohol sensors				4		Countermeasures That Work - NHTSA - Pg 39
Alcohol problem assessment, treatment	0.93	7-9%	N/A	5		Countermeasures That Work - NHTSA - Pg 48
Local primary enforcement belt use laws				4		Countermeasures That Work - NHTSA - Pg 120
Increased belt use law penalties				4	Effectiveness has been demonstrated for increased fines but has not yet been demonstrated for driver's license points.	Countermeasures That Work - NHTSA - Pg 121
Short high-visibility belt law enforcement				5	Used in many jurisdictions but often only once or twice each year	Countermeasures That Work - NHTSA - Pg 123
Combined enforcement, nighttime				4		Countermeasures That Work - NHTSA - Pg 126
Supporting enforcement				5		Countermeasures That Work - NHTSA - Pg 129
Strategies for low-belt-use groups				4		Countermeasures That Work - NHTSA - Pg 130
Strengthening child/youth occupant restraint laws		N/A	N/A	5		Countermeasures That Work - NHTSA - Pg 133
Short high-visibility CR law enforcement				5	Used in many jurisdictions but often only once or twice each year	Countermeasures That Work - NHTSA - Pg 135
Speed Limits		N/A	N/A	5	When enforced and obeyed effectiveness is rated a 5-star.	Countermeasures That Work - NHTSA - Pg 159
Automated enforcement		N/A	N/A	5	The cost can be covered by income of citations	Countermeasures That Work - NHTSA - Pg 163
High visibility cell phone/text messaging enforcement		N/A	N/A	4		Countermeasures That Work - NHTSA - Pg 200
Referring older drivers to DMVs				4		Countermeasures That Work - NHTSA - Pg 294
License restrictions				4		Countermeasures That Work - NHTSA - Pg 297
Pedestrian safety zones				4		Countermeasures That Work - NHTSA - Pg 331
Bicycle helmet laws for children	0.12	88%		5		Countermeasures That Work - NHTSA - Pg 357

Source: NHTSA, Countermeasures That Work, Seventh Edition, 2013, Accessed March 2015. <http://www.nhtsa.gov/staticfiles/nti/pdf/811727.pdf>.

Appendix C

Project Service Life

UPDATED MAY 2015

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ARIZONA HIGHWAY SAFETY IMPROVEMENT PROGRAM

Service Life (Years)

INTERSECTION PROJECTS

Channelization, left-turn bay	10
Traffic Signals	10
Combination of 10 and 11	10
Sight distance improvement	10
Other intersection improvements, except structures	

CROSS SECTION PROJECTS

Pavement widening, no lanes added	2
Lanes added without new median	20
Highway divided, new median added	20
Shoulder widening or improvement	20
Combination of 20 - 23	20
Skid treatment - grooving	10
Skid treatment - overlay	10
Flattening, clearing side slopes	20

STRUCTURES

Widening bridge or major structure	20
Replace bridge or major structure	30
New bridge or major structure (except 34 and 51)	30
Minor structure	20
Pedestrian over- or under-crossing	30
Other structure	20

ALIGNMENT PROJECTS

Horizontal alignment changes (except 52)	20
Vertical alignment changes	20
Combination of 40 and 41	20
Other alignments	20

RAILROAD GRADE CROSSING PROJECTS

Flashing lights replacing signs	10
Elimination by new or reconstructed grade separation	30
Elimination by relocation of highway or railroad	30
Illumination	10
Flashing lights replacing active devices	10
Automatic gates replacing signs	10
Automatic gates replacing active devices	10
Signing, marking	10
Crossing surface improvement	10
Other railroad grade crossing improvement	10

ROADSIDE APPURTENANCES

Traffic Signs	6
Breakaway sign or luminaire supports	10
Road edge guardrail	10
Median barrier	1
Markings, delineators	2
Lighting	15
Improved drainage structures	20
Fencing	10
Impact attenuators	10
Other roadside improvements	10